REMARKS

Applicants have thoroughly considered the Examiner's remarks in the final Office action mailed April 4, 2005 and respectfully acknowledge the Examiner's allowance of claims 20-22. By this Amendment B, claim 23 has been canceled. Claims 1-22 are now presented in the application for further examination and applicants request reconsideration of the claims in view of the following remarks. The remarks follow the sequence of the Office action.

Rejections Under 35 U.S.C § 112

Claims 1-19 stand rejected under 35 U.S.C 112 second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that applicants regard as the invention. In particular, the Office states that it is unclear what applicant intends by an integral external reinforcement, and that this claim element will be interpreted as an external reinforcement. (See Office action at page 2.) During examination, the claims must be interpreted as broadly as their terms reasonably allow. *In re American Academy of Science Tech Center*, 367 F.3d 1359 (Fed. Cir. 2004). In this instance, the plain meanings of "integral external reinforcement" and the teachings of the present application reasonably allow applicants' interpretation as set forth below.

As explained in the present application, there are two main components of mechanical forces in the windings of high field magnet coil, namely, a radial force that tends to expand the diameter of the coil and an axial force at each end that tends to make the coil shorter. According to embodiments of the present invention, a conductor (i.e., a superconducting wire forming the magnet coil) and a reinforcement wire are ***first wound in sequence and then epoxy impregnated together in a common epoxy impregnation and cure process***. In other words, the specification adequately describes reinforcement external to the magnet coil (e.g., a reinforcement wire is wound ***on*** the coil) and integral with the magnet coil (e.g., both the reinforcement wire and the magnet coil are in a ***common*** epoxy impregnation). This coil configuration is referred to as having ***integral external reinforcement*** because it achieves the primary objectives of radial and axial

mechanical support of the conductor windings in a superior manner by having essentially the same strength at the interface between the coil 102 and reinforcement 108 as within the two. In other words, although the reinforcement wire is external to the magnet coil it is integrated with the coil via the common epoxy impregnation process. In light of the foregoing, applicants submit that the phrase "integral external reinforcement" as recited in the claims is definite

Rejections Under 35 U.S.C § 103

Claims 1-10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Koyama et al., U.S. Patent No. 5,606,300, in view of Ito, Japanese Patent No. 58,194,309 A. The Office acknowledges that the Koyama reference does not disclose reinforcement of the coil. But the Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time the invention was made to wrap the coil of Koyama with the reinforcement wire of Ito to prevent the movement of a superconductive wire due to electromagnetic force thereby improving stability. As explained below, the cited references, even when combined as suggested in the Office action, fail to teach or suggest all of the features of applicants' claims. Thus, *prima facie* obviousness has not been established. See MPEP 2142 and 2143.

Claim 1 recites, in part, a superconducting magnet having a bore width greater than approximately 100 millimeters and "an ***integral external reinforcement*** on at least one of the superconducting coils". According to claim 1, "said reinforcement [is] ***impregnated in the epoxy together with the reinforced at least one of the superconducting coils*** for providing structural reinforcement to the magnet in both radial and axial directions." Although Koyama discloses a superconducting magnet comprising a superconducting coil impregnated with an epoxy resin, it fails to disclose an external reinforcement coil, let alone an external reinforcement coil integral with the superconducting coil as recited in claim 1. To remedy the deficiency, the Examiner relies on the teachings of Ito. However, Ito merely discloses a conventional, non-integral reinforcement technique that is generally limited to providing structural support in only the radial direction. As described in the present application, this technique can be weak

in the axial direction, where spaces between the turns in the reinforcement winding reduce the stiffness in the axial direction. (See application page 4, paragraph 12.)

Those skilled in the art are generally aware of two methods for applying epoxy to a coil: a vacuum impregnating method and a wet lay-up method. For example, a conductor, such as Niobium-Tin, is first wound on a winding machine to form the magnet coil. The coil is heat treated for a period of time (e.g., "baked" at 700 °C for several days) so molecules in the coil react to form a super conductor. As described in the present application, this winding and heating of the coil is referred to as "wind and react." (See application page 4, paragraph 13). Thereafter, the heat treated coil may be epoxy impregnated by vacuum impregnation. In the wet lay-up method, an epoxy is applied to the outer surface of the wound coil or between layers during winding and then allowed to cure. Notably, a coil having epoxy applied by the wet lay-up method cannot be heat treated thereafter because the epoxy would deteriorate during the heat treatment process.

The present application describes winding the reinforcement wire on the magnet coil prior to epoxy impregnation, and prior to heat treatment, to ensure a strong bond between the conductor winding and the reinforcement winding. (See application page 11, paragraph 47). After the magnet coil and reinforcement winding are subjected to heat treatment to react the superconductor, the magnet coil and reinforcement winding are impregnated together with epoxy. The combined assembly (i.e., coil and reinforcement winding) is filled with epoxy in a standard vacuum impregnation process creating a high strength bond between the epoxy, the superconductor coil, and the reinforcement winding; thereby providing an integral external reinforcement. (See application page 13-14, paragraph 53). In other words, when cured, the epoxy-impregnated reinforced coil has a high strength interface between the coil and reinforcement wire.

Nothing in the cited references, whether considered in combination or separately, suggests each and every aspect of claim 1. Koyama merely discloses a conventional superconducting coil having a particular resin applied to suppress microcrack generation. Ito teaches spirally winding a securing band, under a high tension, on the outer periphery of a bobbin-wound superconductive magnet. As described in the present application, even if a reinforcement winding (such as taught by Ito) is applied to the coil (such as taught by Koyama) there are major drawbacks. For example, in order to apply Ito's

reinforcement winding to Koyama's finished coil (after the coil has already been epoxy-impregnated), the coil must be refitted in the winding machine for the application of the reinforcement. Although this requirement may not be not severe for a small coil, as the size of the coil increases for higher field magnets, such as the wide bore magnet of claim 1 (which can weigh over a ton), this processing step becomes increasingly burdensome. Furthermore, applying epoxy later to the reinforcement cannot achieve the desired bond between the reinforcement and the coil winding because fresh epoxy would have to be applied by a wet lay-up process over the already cured epoxy. In other words, the epoxy of the reinforcement wire and the epoxy of the magnet coil cannot be molecularly linked. Thus, the strength of the interface between the coil and the reinforcement winding as taught by the combination of Koyama and Ito would be inferior. (See application page 5, paragraph 14).

For these reasons, applicants submit the coil of Koyama and reinforcement wire Ito cannot be impregnated together via a common epoxy and cannot provide integral external reinforcement as set forth in claim 1. The distinction between applicants' inventions and the teachings of the cited references is made even clearer in claim 2, which requires a wind and react conductor. As explained above, the combination of Koyama's coil and Ito's reinforcement would either suffer from an unbonded epoxy interface or the epoxy would be destroyed during the heat treatment to react the conductor.

Claims 12-18 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Koyama in view of Ito and in further view of Huang et al., U.S. Patent No. 6,147,844. However, Huang also fails to teach or suggest integral external reinforcement as claimed and described in the present application.

Thus, whether considered alone or in combination, the cited references, fail to teach or suggest each and every element of claim 1, including an integral external reinforcement. Therefore, claim 1 is believed to be allowable over the cited references.

Claims 2-19 depend from claim 1 and are believed to be allowable for at least the same reasons as the claim from which they depend.

Claims 20-22 have been allowed.

It is felt that a full and complete response has been made to the Office action, and applicants respectfully submit that claims 1-22 are in condition for allowance. If the Examiner feels, for any reason, that a personal interview will expedite the prosecution of this application, he is invited to telephone the undersigned.

The fact that applicants may not have specifically traversed any particular assertion by the Office should not be construed as indicating applicants' agreement therewith.

Any required fees or overpayments should be applied to Deposit Account No. 19-1345.

Respectfully submitted,

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